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AUTHOR Grimaldi, Candace M.
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ABSTRACT

A study explored whether instruction involving an emphasis on study skills could help seventh grade students retain material encountered in science classes. Subjects were 32 students from two intact science classes in a predominately white, middle class school in New Jersey. The experimental group received an advance organizer as an overall summary of a textbook chapter they were studying to help them in organizing the content. They were introduced to the chapter; were told to look at headings, pictures, and diagrams; pronounced and defined vocabulary terms; and noted names of people and places relevant to the chapter. Each day, a review of the previous lesson was conducted before the new lesson was begun. The control group was taught without the use of any learning aid. All students were tested at the end of each chapter. Results indicated a significant difference between the means of the samples in favor of the experimental treatments. The findings suggest that study skills can help students retain science material content. (Appendixes contain pretest and posttest raw scores of the samples and samples of pretests and posttests used in the study. Twenty-six references are included.) (FL)

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Can Improvement of Retention of the Science Content Area Be Had By the Addition of Study Skills?

by

Candace M. Grimaldi

Presented in Partial Fulfillment

of the Requirements for the Master of Arts Degree

Kean College of New Jersey

May, 1987

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ABSTRACT

This study involved two samples of seventh grade students consisting of thirty-two boys and girls. It was hypothesized that there would be an improvement in the retention of science content when study skills were re-enforced in the lesson for the experimental sample. The study lasted for a sixteen week period.

An analysis of the results indicated that there was a significant difference bewteen the means of the two samples in favor of the experimental sample. There was an increase in the mean achievement of the experimental sample suggesting that study skills can help in the retention of the science content.

ACKNOWLEDGEMENTS

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"Young people of all abilities and aspirations have the right of access to the world of science and it is incumbent upon all teachers and administrators to ensure that ways are found whereby science studies can become accessible to all," advocates Wilson (1986).

Many students in the upper elementary grades lack a knowledge of study skills to help them in learning the content materials, according to Herber (1978). There is a need to teach such study skills in content areas such as science. Science textbooks contain difficult vocabulary and concepts. Students need help in learning and applying the skills that are essential for acquiring that knowledge, developing understandings, and making applications.

Often a mismatch occurs between the student's reading ability and the reading ability of the text. Therefore, further additional aid via study skills may fill the gap. A given student's success may depend on whether he can understand content and apply the knowledge to his understanding of difficult science concepts, according to Swain (1985).

It has been shown by Herber (1978), that teachers' attitudes can complicate the learning process. Teachers may feel they should teach the course and not teach reading. Such teachers do not realize that they should be teaching the discipline in such a way that every student can reach his ultimate potential, and that reading skill achievement needs to parallel acquisition of knowledge from the content

area. According to Fraenkel (1980), no one is better qualified to teach the specific reading skills than the discipline teacher himself.

Reading skills, according to Herber (1978), need to be incorporated into the teaching of content areas to help students cope with the difficult material in their present and future work.

Studies by Yore (1986), have explored relationships between the lesson structure and the learner structure represented by cognitive style. The studies involved chemistry and physics topics. Studies indicate field-independent students were able to handle a low-structure inquiry strategy when dealing with chemistry and physics than were field-dependent students. Another advocate, Tannebaum (1982), reported a significant interaction effect between lesson structure and cognitive style for secondary students studying nutrition. Increased lesson structure had a slightly higher level of improvement in science achievement as compared to those who had no increased lesson structure, according to Yore (1986). Lesson structure is important as a factor for helping students in learning the content area material as shown by these studies.

Much evidence exists (Wolf, 1978; Karahalio, 1979; Hawk, 1986; Stoodt and Balbo, 1979), to support the utilization of study skills, including advanced organizers in various content fields. But little evidence exists to

show specific values when applied to science. While one can assume such values should exist, assumptions do not convince teachers to apply such skills.

HYPOTHESIS

Study skills can help the improvement of learning science content. According to Herber (1978), if students are taught specific reading skills that correspond to content with practical application, their performance in the content area will improve. To determine the validity of these findings and supply evidence related to science content, the following study was designed. It was hypothesized that study skills could help a sample of students in the learning of the science content when compared to a second sample which does not receive such instruction as measured by chapter tests.

DEFINITIONS

Certain terms used in this study need to be defined as they are limitations of the study and predicate the basis of the experiment. These terms are defined according to Herber (1978). Study skills are divided into four categories: (1) vocabulary, (2) comprehension, (3) selecting and organizing information and (4) locating information. An advanced organizer is a written aid to supplement in an explanatory manner the reading and studying of the text. A skill builder is used as a review for a lesson. It can be a map review, fact or opinion exercise, choose the best title, graph or reading chart,

puzzle, cause and effect, and others.

PROCEDURES

The sample consists of two seventh grade classes in life science. One seventh grade group of sixteen students was identified as the control sample and the second class of sixteen students as the experimental sample. Both groups were predominately white, middle class students from Kenilworth, New Jersey. The academic performance was average for both samples. The two samples used the textbook, "Exploring Living Things" by Smith, Frazier, and Magnoli (1980).

The experimental sample received an advanced organizer as an overall summary of the content material in the chapter, to aid in the organization of the chapter material.

The students were introduced to the chapter. They were asked to look at chapter sub-headings, pictures, diagrams, and any other pertinent information explaining the chapter. Vocabulary was learned by pronouncing and defining the terms. Important names of people and places relevant to the chapter were brought to their attention. Each day a review from the day before occurred prior to the new lesson of that day. A brief discussion of the review followed.

The review of a lesson was done with a skill builder, such as a map, chart, graph, cause and effect exercise, graphic organizer, or other such additional

items.

At the end of each chapter, students were given a review, then a chapter test.

The control sample was taught without the use of any study-type or learning aids to assist them in mastering the content material. Tests were administered at the end of a chapter.

Each sample was tested on the same publisher made test at the end of the instructional period.

RESULTS

Table I shows the initial data mean, standard deviation, t, and degrees of freedom used in comparing the chapter test scores of the control and experimental samples. The t of .40 indicates that there is no significant difference bewteen the two mean samples in terms of their ability as measured by pre-test scores. The makeup of each group was essentially the same.

Table I

Pre-test Data of Samples

Sample	Mean	Standard Deviation	t	DF
Control	75.00	10.89		
Experimental	77.19	10.54	.40	31

Table II shows the post-test data mean, standard deviation, t, and degrees of freedom used in comparing the post-test scores of the control and experimental samples. The t of 1.76 indicates that there

was a significant difference between the means of the samples at the conclusion of the study, with a significance $< .05$ for

Table II

Post-test Data of Samples

Sample	Mean	Standard Deviation	t	Df
Control	70.00	10.22	1.76	31
Experimental	78.25	13.43		

one-tailed tests. It can be noted, too, that although at the outset the variation in samples was quite similar, differences in the achievement of the experimental sample is suggested by the larger mean and difference in variance on the second chapter test used at the conclusion of the study. While the control sample mean was reduced five points from pre-testing, the experimental sample's mean increased modestly. While reliability of this testing instrument must be considered, the initial and final tests measured different content and are not different forms of the same instrument. The mean difference between the samples, therefore, is real and indicates the effect of the treatment.

CONCLUSIONS AND IMPLICATIONS

The significance of the problem, retention of the science content, is such that science teachers should make a determined effort to develop the necessary reading skills needed for future success.

The data for the post-testing indicated a significant difference in favor of the experimental treatment

between the mean of the samples. This gain can be associated with the effect of the use of the experimental procedures. Reasons for only a comparatively modest point difference in favor of the experimental sample may be due to the time factor involved, and, therefore, it is suggested that future experiments be extended for longer periods to determine whether further mean differences between treatments would result.

While it is important to recognize that the results of this research can only be applied to these groups, the results appear to be applicable to all teaching in all content areas. Content teachers should be made aware of teaching strategies exemplified in the procedures, and to recognize the extent of which the content is learned when reading skills are utilized in instruction.

Improved Retention of Science: Related Literature

In a recent article from NJEA Review, 1986, U.S. Education Secretary, William Bennett spoke about elementary schools making major changes in the way they teach reading, social studies, and the sciences, particularly in the upper grades. He stated that the academic performance of older students who must learn more complicated material lags behind that of their counterparts in other countries. Mr. Bennett maintained that children need a more defined "common body of knowledge"-core democratic teachings and basic learning skills which allow students to think for themselves.

Riley (1978) suggested that teaching reading in the content area was needed. One of the components of an elementary program is the application of skills to the content material.

Herber (1978) suggested that teaching reading in the content area should be taught functionally. Functional teaching of reading has four components: (1) identification of content; (2) selection of skills and processes necessary for acquiring concepts in the material to be utilized; (3) designing instruction; (4) creating reading and learning tasks that lead to the acquisition of content concepts and relevant strategies that aid in gaining an understanding of those concepts.

Riley (1979) concluded that a definition of reading in the content area that is consistent with the functional teaching of reading is: "Teaching reading in the content area is instruction that facilitates the

learning of content area concepts through careful design and implementation (by the content area teacher) of lessons that focus on the selective processes, theoretically based or empirically verified." Educators will be aided by the improvement of teaching reading in the content area by using this definition.

According to Yore (1986) recent studies have explored the relationship between lesson structure and learner structure represented by cognitive style. Studies indicate students were able to handle a low-structure inquiry strategy when dealing with chemistry and physics topics than field-dependent students. Tannebaum (1982) reported a significant interaction effect between lesson structure and cognitive style for secondary students studying nutrition. Increased lesson structure had a slightly higher level of improvement in science achievement as compared to those who had no increased lesson structure, according to Yore (1986).

Kamm (1978) reports a five year study on the effects of a skill-centered approach to the teaching of reading. This can be applied to the content area. After this five year study, testing showed that the percentage of students scoring above the national norm is increasing, and this was attributed to the implementaion of the skill-centered approach to reading instruction. The teachers are continuing the teaching and reinforcement of the skill-centered approach, and are very pleased with the improvement of skill application to the content area. It is assumed

that if specific reading skills are taught within the context of materials encountered in the content area instruction, that these skills will more easily transfer to student's daily tasks, than if these were taught in isolation (Ryder, 1978).

Wolf (1978) conducted a study using a control and experimental group. In the experimental group, reading and study skills were incorporated into the content area lessons. The skills that were emphasized were organizational skills, locational skills, reading and rate skills. The experimental group had significantly higher achievement test scores than did the students in the control group.

Cassidy (1977) explains project C.A.R.E. (content area reading enrichment) which ensures that all children receive reading instruction in every content area through the eighth grade. Project C.A.R.E. kits were developed to provide classroom teachers of grades four through eight with materials to help the students become aware of the reading skills and requirements in various content areas and to reinforce and extend their skills. This project was an attempt to make sure that all students received reading instruction in every content area. Cassidy also feels that the content area deserves consideration by all elementary school teachers.

The elements of cognitive development, science process skills, inquiry problem-solving, and scientific reasoning are clearly interrelated according to Yore (1986).

Yore feels that well-defined objectives and instructional strategies contribute to the development of inquiry and problem-solving skills: presentation of models and procedures, especially for disconfirming hypotheses, were found to be effective in aiding student problem-solving.

Smith and Anderson (1986) reported that a formation of a conceptual system similar to discipline structure was positively related to concept attainment. The analysis revealed several factors that contributed to this. The teacher and the curriculum developers held different views about learning and the nature of science, and several problems surfaced about the content and organization of the teacher's guide.

A study conducted by Wagner (1986) investigated the relationship between achievement gains of science students related to two methods of instruction and differences in questioning styles of their teachers. The two methods were an inquiry approach and a reading-recitation approach. Achievement gains were measured in the process skills of science and in content-knowledge. The major findings were: (1) total achievement gains between the methods; and (2) process skills gains between the methods. There was a significant difference in: (1) the questioning styles of teachers between the methods.

Aiello-Nicosia, Sperandeo-Mineo, and Valenza (1986) investigated the relationships among Junior High School science teachers' characteristics (understanding of

science processes and their ability to control variables) and student achievement in science concepts and processes. It showed that teacher ability to control variables was found to be a better predictor of achievement than was understanding of science concepts.

Gussett (1986) examined the relationship of specific reading performance objectives and science achievement in 157 fifth through eight grade students. The information collected allowed the researcher to determine which of the selected performance reading objectives positively affected science achievement. On the basis of the findings, it was recommended that studies and research efforts should be directed towards the individual contributions of specific reading objectives to science achievement and the role of inference in middle school science.

Mitman and Osaki (1986) investigated the combination of student, teacher, curricular or task factors that characterized effective life science instruction at the seventh grade level. Results indicated that teachers carried out instruction through means of recitation, seatwork, and laboratory exercises (in that order). In addition, the teachers rarely made explicit reference to the historical, reasoning, social, or attitudinal implications of the subject matter.

Hansell (1976) outlines a content directed reading thinking activity for content material. He indicated that this should be used instead of simply asking students to

read a passage without any previous knowledge of the content of the material to be read and listed seven basic steps: (1) ask students to examine the initial information, (2) ask the key question. After listing all guesses on the chalkboard (3) the teacher will (4) ask students to read to find out if the author included their guesses. The teacher then (5) asks students to evaluate their guesses in relation to the passage. (6) Clarify the key concepts, and (7) ask open ended questions that encourage generalization and application.

Meeks and Morgan (1978) discuss a technique they term "the interactive cloze procedure" that was used successfully to help middle school students in reading the content area. The procedure involved taking a literary passage and deleting various nouns, verbs, adjectives, or adverbs. The students completed the cloze passage individually, and then were divided into small groups to compare answers and reach joint decisions about their responses. The discussions included reading the intact, original passage and asking students their opinions about their choices as compared to the original passage. This procedure proved successful as it promoted a great deal of discussion about words choices and showed enjoyment of the selection. The students were very involved and enjoyed working together. This procedure can be used with many content areas including science.

Karahalios conducted a study in 1979 and

predicted that there would be a "significant difference among groups as a result of pre-reading experiences," using advanced organizers. An advanced organizer is a "written aid to supplement in an explanatory manner the reading and studying of the text." The students in the study were 76 seventh graders from a small, rural community. There were three random groups of students. Group one was instructed to read the chapter and answer the questions at the conclusion of the chapter.

The second group, given the same instruction, was directed to skim the chapter first paying attention to major headings and boldface vocabulary print and italicized type. Group three, given the same instruction, was given the addition of an advanced organizer. It was a written handout focusing on the major concepts and using an easier vocabulary. At the end of the unit all groups were given identical comprehension tests covering the material in the text. Multiple choice tests were administered. Analysis indicated significant differences among the groups. The most significant difference occurred between groups one and three. It would seem possible to conclude that the overall effect of using advanced organizers increases students' performances in the reading comprehension of the text. Recommendation comes from the authors to conduct a more elaborate study so as to aid teachers in the improvement of reading in the content area.

In addition to advanced organizers, graphic

organizers were used to increase achievement in the middle school life science classes, according to Hawk (1986). The graphic organizers used in this study are a pictorial, visual, or graphic presentation which exemplify a strategy that enables the teacher to provide written and graphic organization to a body of content. Hawk has designed a technique for preparing graphic organizers which may be useful to educators. In studies using graphic organizers at the junior and senior high school levels, a significant increase in student achievement was observed. Graphic organizers used at the college level have proven effective. The results of this study clearly support the use of graphic organizers as a teaching strategy for improving student achievement. The 213 students in the seven classes of life science that used the graphic organizers had an adjusted mean difference between the pre-test and post-test of 21.38, while the 177 students in the eight classes that did not use graphic organizers had an adjusted mean difference of 12.07. Thus, the adjusted mean difference between the two treatments was 9.1. This difference was statistically significant.

According to Swain (1985) an assessment scheme in science should match the nature of the subject, not primarily the curricular material found in that subject. In proposing a framework for assessment in science a number of issues must be raised. These issues reflect that: (1) Science is an interactive force with society.

These issues provide an underlying structure in which the assessment of pupils is linked to the nature of science itself.

A study conducted by Bell and Driver (1986) views student thinking and the learning of science based on a constructivist idea. These ideas are based on the following: (1) our view of science itself, and (2) our view of the learning processes. The authors' views of science itself is that science deals with concepts, ideas, and theories used to interpret the world. Their view of the learning processes can be stated as: (1) Learning outcomes depend not only on the learning environment but also on the knowledge of the learner. (2) Learning involves the construction of meanings. Meanings constructed by students from what they see or hear may or may not be those intended. Construction of a meaning is influenced to a large extent by our existing knowledge. (3) The construction of meaning is a continuous and active process. (4) Meanings, once constructed are evaluated and can be accepted or rejected. (5) Learners have the final responsibility for their learning. There are patterns in the types of meanings students construct due to shared experiences with the physical world and through natural language.

Herber states (1970) that "there is an increasing acceptance of the point of view that the principle place to provide reading instruction is in the content area classrooms, as part of the regular curriculum of each

subject." One of the reasons why this has not been put into the school system is due to the lack of personnel having the proper experience to provide this type of instruction.

Stoodt and Balbo (1979) conducted a study to find out if the integration of study skills and content information into a twelfth grade economics class would result in greater mastery of study skills and content materials as measured by an informal inventory. There were two economic classes of students taught by the same teacher. The experimental groups received instruction in both economics and study skills. The study skills included: outlining, locating information, vocabulary in context, chart interpretation, and study reading. These lesson plans were designed by the reading specialist and the content area teacher. The control group received economics instruction only. Pre-testing and post-testing were conducted by an informal inventory. Analysis showed the experimental groups had significantly higher grades in economics and study skills than did the control group.

Kealy (1980) discusses the help students need in reading the content textbook. He states that the detailed instruction centers on the examination of the individual chapter in the content area textbook. Students focused on the chapter's organization, title, paragraph headings, context clues for new words, and graphics to provide assistance in understanding the context of the chapter. Many students receiving new textbooks turn to the back to

see how many pages they will encounter. If each chapter is discussed as above, the student will have a better attitude in reading the book. It is also favorable to familiarize the the student with the parts of the textbook. This will help the student to have the ability to use more sophisticated tools of learning, once they have overcome the textbook.

A study by Doran and Jacobson (1986) on "What Do Our Nineth Graders Think of Science and School?" shows in a survey that students reported on the methods and materials their school used in the study of science. The students reported they often used textbooks for science learning but only sometimes used library books. Some students never used library books (42%).

Smith and Barrett (1974) set five guidelines for the teacher who wants help for middle grade students to learn to read content material successfully. These guidelines if followed show post-reading activities can be used to reinforce the reading rather than telling the students what they were supposed to have learned while they were reading. The guidelines are: (1) whenever possible have materials relative to the topic being studied available at different levels of reading ability to accomodate the different abilities of students in the class; (2) make reading assignments short when the content is difficult to understand or the writing style is difficult for young readers; (3) know the reading strengths or weaknesses of the students well enough to anticipate difficulties in certain materials; (4) read the

material to be assigned carefully beforehand to become familiar with content, words, sentences, figurative language, or other aspects likely to present problems with comprehension; (5) prepare students for the ideas they will encounter and for the linguistic elements which are likely to give them any problems.

In a study by Head, Lyth and May (1985) showed students lose interest in science in the elementary years. The use of interesting material in the form of supplementary material was provided and helped to stir their interest in science along with helping them to better understand the science concepts.

According to a study on "Teaching Children to Ask Operational Questions in Science," (1986), Allison and Shrigley, showed cognitive conflict may be the catalyst to question asking, and that the teacher modeling dominates the research on training students to ask questions.

It can be concluded therefore, that teachers need to recognize the need for reading instruction in the content area. Reading instruction needs to be a part of the content area teachings. This will help to ensure that students will carry with them the necessary skills needed for successful attainment of goals in their lifetime.

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Appendices

APPENDIX A

Pre-test and Post-test Raw Scores of the Samples

Pre-test October, 1986		Post-test February, 1987	
Experimental	Control	Experimental	Control
63	81	82	80
59	67	52	64
77	74	86	52
82	78	60	72
79	65	88	72
73	59	90	54
89	71	74	60
54	91	93	76
86	96	68	76
80	62	82	64
93	67	90	80
79	69	53	58
76	73	80	74
84	86	82	88
82	89	80	76
79	72	92	74

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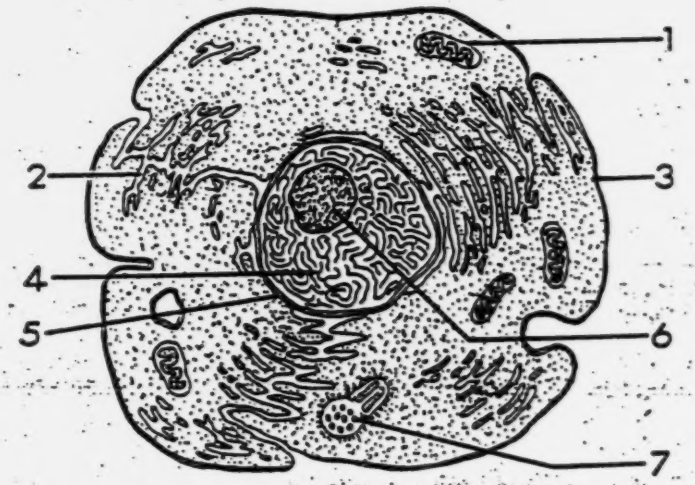
Samples of the Pre and Posttests Utilized in the Study

NAME Pretest SCORE: Number Correct____ x 4 = ____

Chapter 3. CELLS–SMALL PACKAGES OF LIFE

VOCABULARY The name of each numbered part of a cell can be found in the column to the right. Study the diagram of the cell. Write the letter of the name of each cell part on the line beside the numeral for that part.

..... 1.
..... 2.
..... 3.
..... 4.
..... 5.
..... 6.
..... 7.



a. cytoplasm
b. cell membrane
c. nuclear membrane
d. chromatin
e. mitochondria
f. endoplasmic reticulum
g. centrosome
h. nucleolus
i. ribosome

KNOWLEDGE AND UNDERSTANDING Each of the questions numbered *8–20* is followed by four answers. Select the correct answer for each question, and write the letter of that answer on the line beside the numeral.

..... 8. Of the following kinds of cells, which kind is the smallest?
a. ostrich egg cells b. nerve cells c. bacteria cells d. plant cells

..... 9. What name is given to the process of diffusion of water through a membrane?
a. mitosis b. osmosis c. respiration d. metabolism

.....10. During which phase in mitosis do the chromosomes separate and move apart?
a. prophase b. metaphase c. anaphase d. telophase

.....11. Which of the following is found in plant cells but not in animal cells?
a. cell wall b. cell membrane c. cytoplasm d. nucleus

.....12. What name is given to the groups of proteins that control how fast metabolism is carried on?
a. ribosomes b. carbohydrates c. mitochondria d. enzymes

.....13. During which phase in mitosis do new nuclear membranes form?
a. interphase b. prophase c. anaphase d. telophase

.....14. During which phase in mitosis is an exact copy of each chromosome made?
a. interphase b. prophase c. anaphase d. telophase

.....15. Where are the ribosomes found?
a. in the nucleus c. on the endoplasmic reticulum
b. on the cell membrane d. in the centrosome

.....16. What name is given to the movement of certain molecules from places where there are many of those molecules to places where there are not as many?
a. respiration b. reproduction c. interphase d. diffusion

(OVER)

.....17. Which of the following statements does *not* describe enzymes?
a. They are made in the ribosomes.
b. They are certain groups of proteins.
c. They are made in the mitochondria.
d. They control how fast metabolism is carried on.

.....18. What is the cytoplasm?
a. all the living matter within the cell membrane but outside the nucleus
b. tiny two-walled membranes that form a network between the nuclear membrane and the cell membrane
c. tiny threadlike parts found within the nucleus
d. tiny threads formed between the centrioles during mitosis

.....19. How many phases are there in mitosis?
a. two b. three c. four d. five

.....20. What are carbohydrates?
a. molecules resulting from cells breaking down food to get energy
b. parts of a cell found in the cytoplasm
c. food materials, such as starches and sugars, used by cells
d. a certain group of proteins that control how fast metabolism is carried on

CONCEPTS Each of the incomplete sentences numbered *21–25* is followed by four terms or phrases. On the line beside the numeral, write the letter of the term or phrase that best completes the sentence.

.....21. The function of the cell membrane is to
a. regulate what goes into and out of a cell.
b. make proteins and enzymes.
c. break down food to give off energy.
d. help a living thing keep a certain shape.

.....22. Food is broken down and energy is released in the
a. mitochondria. b. ribosomes. c. chromosomes. d. endoplasmic reticulum.

.....23. One way that mitosis in plant cells differs from mitosis in animal cells is that plant cells
a. have centrioles, while animal cells do not.
b. do not form spindles as animal cells do.
c. do not have centrioles, while animal cells do.
d. form a furrow, or groove, across the cytoplasm, while animal cells are divided by a cell plate.

.....24. Mitosis is the process by which
a. water moves across a membrane.
b. molecules move from places where there are many of those molecules to places where there are fewer molecules.
c. food material is broken down into smaller molecules to give off energy.
d. cells reproduce.

.....25. The parts of a cell that control what new cells will be like are the
a. centrosomes. b. chromosomes. c. ribosomes. d. mitochondria.

EXTRA CREDIT If your teacher tells you to, use your own words to answer the following question.

26. Of what use are cell walls to plant cells and to plants?

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NAME_____ SCORE: Number Correct_____ × 4 = _____

Chapter 4. CLASSIFYING LIVING THINGS

VOCABULARY For each term in *Column A*, find a phrase that describes the term in *Column B*. Then write the letter of that phrase on the line beside the numeral of the term it describes.

COLUMN A	COLUMN B
_____ 1. genus	a. class that includes pine trees
_____ 2. class	b. group next in line below order in classifying living things
_____ 3. phylum	c. to put things into groups
_____ 4. classify	d. class that includes sunflowers
_____ 5. order	e. tiny living thing that does not seem to be either a plant or an animal but is like both in some ways
_____ 6. kingdom	f. term used by Linnaeus to describe a group of species that are alike in structure only in certain ways
_____ 7. species	g. group next in line below kingdom in classifying living things
_____ 8. family	h. name of three major groups into which living things are classified
_____ 9. Gymnospermae	i. group of living things that are very much alike and are able to produce new living things of the same kind
_____ 10. protist	j. group next in line below phylum in classifying living things
	k. language used in naming groups into which living things are classified
	l. group next below class in classifying living things

KNOWLEDGE AND UNDERSTANDING Each of the incomplete sentences numbered *11–20* is followed by four terms or phrases. On the line beside the numeral, write the letter of the term or phrase that best completes the sentence.

_____ 11. The first person to use the term "species" to describe living things that have the same kind of parents was
a. Linnaeus. b. Hooke. c. Ray. d. Schleiden.

_____ 12. Members of the same order are more alike than members of the same
a. phylum. b. family. c. genus. d. species.

_____ 13. Each kind of living thing has a two-word scientific name that tells its
a. phylum and class. c. family and genus.
b. order and family. d. genus and species.

_____ 14. The first person to use the term "genus" and give each kind of living thing a two-word scientific name was
a. Linnaeus. b. Hooke. c. Ray. d. Schleiden.

_____ 15. Long ago people probably classified living things by
a. likenesses and differences in structure. c. how they moved about.
b. whether or not they were useful. d. how they got food.

_____ 16. Pine trees and sunflowers belong to the same
a. order. b. genus. c. phylum. d. family.

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.....17. A lion, a tiger, and a house cat all belong to the genus
a. Felis. b. Equus. c. Cercis. d. Homo.

.....18. Most biologists divide all living things into
a. two kingdoms. b. three kingdoms. c. four kingdoms. d. five kingdoms.

.....19. Biologists decide what kinds of organisms should be grouped together based on the organisms'
a. differences. b. common names. c. likenesses. d. scientific names.

.....20. One characteristic of a species is that
a. male and female members can mate and have offspring that can also mate.
b. all members look exactly alike.
c. members have more differences than they have likenesses.
d. members are not alike in any way.

CONCEPTS Each of the questions numbered *21–25* is followed by four answers. Select the correct answer for each question, and write the letter of that answer on the line beside the numeral.

.....21. Which of the following pairs are most closely related?
a. lion and house cat c. frog and snake
b. mushroom and grass d. robin and flying squirrel

.....22. What happens as living things are classified from kingdoms to species?
a. The number of different kinds of living things in each group gets larger.
b. The members of each group become less and less alike in structure.
c. The number of different kinds of living things in each group becomes smaller.
d. There is no change in the number of living things in each group.

.....23. How do biologists decide how to classify living things?
a. by how living things get food c. by their common names
b. by likenesses and differences in structure d. by whether living things are useful or not

.....24. What is the difference between scientific and common names for living things?
a. Many living things may have the same scientific name, but each kind of living thing has a different common name.
b. Different kinds of living things may have the same common name, but each kind of living thing has a different scientific name.
c. Scientific names are always in English, while common names are always in Latin.
d. There is no difference between scientific and common names.

.....25. Why do all biologists give Latin or Latinized names to living things?
a. Biologists in many different countries have agreed to use Latin, a language most of them know something about.
b. Latin names do not describe the characteristics of a living thing.
c. People in many different countries speak Latin, giving common names to living things.
d. No one knows why biologists use Latin to name living things.

EXTRA CREDIT If your teacher tells you to, use your own words to answer the following question.

26. Into what groups is each kind of living thing, such as a sunflower, classified?

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NAME_____ SCORE: Number Correct_____ × 4 = _____

Chapter 14. FLOWERING PLANTS

VOCABULARY For each term in *Column A*, find a phrase that describes that term in *Column B*. Then write the letter of that phrase on the line beside the numeral of the term it describes.

COLUMN A	COLUMN B
..... 1. ovary	a. flower having pistils or stamens but not both
..... 2. stamen	b. largest known flower in the world
..... 3. monocot	c. flowering plant having two seed leaves in its seeds
..... 4. dicot	d. part of a flower in which eggs are formed
..... 5. humus	e. partly decayed plant and animal matter in soil
..... 6. nectar	f. part of a flower in which pollen forms
..... 7. stigma	g. flower that has sepals, petals, stamens, and pistils
..... 8. duckweed	h. smallest known flower in the world
..... 9. complete	i. flowering plant having one seed leaf in its seed
.....10. imperfect	j. flower having stamens and pistils but missing petals or sepals
	k. top part of a pistil
	l. sweet liquid formed by a flower

KNOWLEDGE AND UNDERSTANDING Each of the incomplete sentences numbered *11–19* is followed by four terms or phrases. On the line beside the numeral, write the letter of the term or phrase that best completes the sentence.

.....11. The largest known flower in the world is that of a
a. rose. b. maple. c. *Rafflesia*. d. duckweed.

.....12. The names of two families of monocots are
a. rose and pea. b. grass and orchid. c. nightshade and composite. d. pea and grass.

.....13. Seeds from a fresh tomato are often treated before planting
a. to remove substances in the seed coats that keep the embryos from growing right away.
b. because tomato flowers are incomplete.
c. to keep the embryos from growing.
d. to pollinate the flowers of the plant.

.....14. A medicine that is used to treat malaria and that is made from a flowering plant is
a. atropine. b. flax. c. quinine. d. humus.

.....15. The names of two dicot families are
a. pea and rose. b. orchid and grass. c. orchid and composite. d. grass and mustard.

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.....16. The stem of a dicot has
a. vascular bundles scattered throughout the stem.
b. vascular bundles around the edge of the stem.
c. no vascular bundles.
d. parallel veins.

.....17. The grass family is one of the most important families in terms of producing
a. beautiful flowers. b. food. c. medicines. d. wood.

.....18. A flower that has stamens, pistils, and sepals but no petals is said to be
a. complete. b. imperfect. c. incomplete. d. pollinated.

.....19. The colorful petals of many flowers may serve to
a. attract insects. b. form pollen. c. form eggs. d. protect the flower bud.

CONCEPTS Each of the questions numbered 20–25 is followed by four answers. Select the correct answer for each question, and write the letter of that answer on the line beside the numeral.

.....20. How do insect-pollinated flowers differ from wind-pollinated flowers?
a. Most wind-pollinated flowers have colorful petals, while insect-pollinated flowers do not.
b. Most wind-pollinated flowers have nectar, while insect-pollinated flowers do not.
c. Most insect-pollinated flowers have strong odors, while wind-pollinated flowers do not.
d. Most insect-pollinated flowers have very long stigmas, while wind-pollinated flowers do not.

.....21. Why is having humus in the soil important in growing plants?
a. Humus kills weeds.
b. Humus keeps soil very dry.
c. Humus has minerals and holds large amounts of water.
d. Humus causes plant and animal matter to break down.

.....22. Which of the following uses for flowering plants is probably the most important use?
a. for flowers b. for wood c. for cloth d. for food

.....23. What are the four main parts of a flower?
a. stamen, pistil, petal, and sepal
b. stamen, stigma, ovary, and petal
c. stigma, ovary, petal, and sepal
d. pistil, ovary, stamen, and sepal

.....24. Which two parts do flowers need in order to form seeds?
a. sepals and petals b. stamens and pistils c. sepals and stamens d. petals and stamens

.....25. What are the two large groups into which all flowering plants are classified?
a. perfect and imperfect
b. complete and incomplete
c. monocots and dicots
d. composites and orchids

EXTRA CREDIT If your teacher tells you to, use your own words to answer the following question.

26. How is the way seeds are formed in a pinecone different from the way seeds are formed in a tomato? In what ways are the forming of pine seeds and of tomato seeds alike?

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NAME Posttest SCORE: Number Correct____ × 5 = ____

Chapter 15. SPONGES AND COELENTERATES

VOCABULARY Each of the incomplete sentences numbered *1–10* can be completed by using a term from the following list. Read each sentence. From the list select the term that best completes the sentence, and write the letter of that term on the line beside the numeral.

a. asexual	d. coelenterates	g. radial symmetry	j. sperm
b. tentacles	e. carnivorous	h. spongin	k. spicules
c. pores	f. collar	i. central cavity	l. sexual

..... 1. Animals, such as jellyfish, that have a round shape are said to have ....(1)....

..... 2. The wall of a sponge contains many tiny openings, or ....(2)....

..... 3. In ....(3).... reproduction, an egg and a sperm combine to form the first cell of a new living thing.

..... 4. Corals, hydras, jellyfish, and sea anemones belong to a group called ....(4)....

..... 5. The space in the center of a sponge or coelenterate is called the ....(5)....

..... 6. Male sex cells are ....(6).... cells.

..... 7. Food is trapped and digested in the ....(7).... cells of a sponge.

..... 8. A hydra has armlike parts called ....(8).... around its mouth.

..... 9. All coelenterates are ....(9)....—that is, they eat other animals.

.....10. Some sponges have hard parts called ....(10).... within the jellylike material.

KNOWLEDGE AND UNDERSTANDING Each of the questions numbered *11–17* is followed by four answers. Select the correct answer for each question, and write the letter of that answer on the line beside [redacted]

.....11. Which of the following are formed when sponges reproduce asexually?
a. larvae b. gemmules c. collar cells d. spicules

.....12. Where do most sponges live?
a. in warm, shallow seawater
b. about five kilometers below the ocean surface
c. in fresh water
d. floating on the surface of water

.....13. How do jellyfish differ from most coelenterates?
a. They have several openings into the central cavity.
b. They form limestone "skeletons" around themselves.
c. They do not have tentacles.
d. They appear to be upside down.

.....14. What name is given to a ring-shaped island built up by colonial corals?
a. volcano b. gemmule c. atoll d. spicule

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.....15. Where are coral reefs formed?
a. only in fresh water
b. only in warm ocean water
c. only in cold ocean water
d. everywhere that coral animals live

.....16. What name is given to the early form in the development of a sponge?
a. larva b. gemmule c. spicule d. spongin

.....17. How does a sponge take in food and water?
a. through the large opening into the central cavity
b. by pushing the food and water into the central cavity with its tentacles
c. through the collar cells in the outer cell layer
d. through pore cells in the wall of the sponge

CONCEPTS Each of the incomplete sentences numbered *18–20* is followed by four terms or phrases. On the line beside the numeral, write the letter of the term or phrase that best completes the sentence.

.....18. Sponges are often described as being simple animals because
a. they live only in warm, shallow seas.
b. they have many tiny pores in their body wall.
c. even though they are made up of many cells, each cell acts like a one-celled organism.
d. they have tentacles and radial symmetry.

.....19. The structure of sponges is like that of coelenterates in that both
a. resemble a sack with one large opening at one end of the central cavity.
b. have many tiny pores in their body walls.
c. have tentacles that they use to catch other animals.
d. form hard skeletons of limestone around their bodies.

.....20. A coral reef is formed
a. by large numbers of sponges living together.
b. by limestone settling out of ocean water.
c. over many thousands of years as layers of coral skeletons build up.
d. by many different kinds of coelenterates.

[redacted] If your teacher tells you to, use your own words to answer the following question.

21. How are a hydra and a jellyfish alike? How are they different?

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